

## PEDESTRIAN ON FOOTBRIDGES, VERTICAL LOADS AND RESPONSE

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### Summary

This paper is a synthesis of experimental and theoretical investigations on dynamics of pedestrian bridges under vertical load. Finally, a simple procedure of investigation of dynamic response of a footbridge is presented. The subject is divided into three issues:

- 1) A pedestrian as a vertical dynamic load on footbridges, vertical lock-in effect  
theoretic load function for walking and crouching.
- 2) Crowd walking on a footbridge - pedestrian flow.
- 3) Response of the footbridge – numeric and site test results,
  - deck vertical vibrations under vertical excitation,
  - deck lateral vibrations under vertical excitation,
  - cable stayed footbridge - vibrations of stays.

In the author's opinion, the presented procedures for numeric analysis of footbridges are forceful and useful for estimating the dynamic character of a footbridge at the design stage.

**Keywords:** footbridge, dynamics, vertical pedestrian load, response, guidelines for designing.

### 1. Introduction

We all know that a modern footbridge needs modern techniques of analysis. Thanks to footbridge conferences we are participants of a big discussion about theoretic evaluation, comfort criteria and control of vibration. A very important issue of this discussion is a numerical simulation of the response of a footbridge under dynamic excitation. The main and most spectacular problem is a dynamic pedestrian action on a bridge.

The following paper presents synthesis of recent research investigations made by the author concerning pedestrian vertical load on a bridge. Finally, guidelines for designers are included.

### 2. Pedestrian on the bridge.

#### 2.1 Load function

On the base of a laboratory test, made on the fitness treadmill with electric steering placed on force cells (fig.1), a load function of a single pedestrian was developed [1] (fig.2)